APPENDIX G
PREPARATION OF DREDGE COST ESTIMATES

1. General

This appendix provides guidance for estimating the dredging portion of a project. Associated work items, such as clearing and grubbing, dike construction, disposal area operation and maintenance, drilling and blasting, and environmental protection, are not included and should be estimated separately in accordance with other parts of this regulation. Each Cost Engineer should be aware of various techniques that have proven to produce the most accurate results for specific projects in their district/MSC. All dredging estimates will be prepared in accordance with Corps of Engineers Dredge Estimating Programs (CEDEP) and will contain a narrative documenting reasons for decisions and selections made by the Cost Engineer. Figure G-1, at the end of this appendix indicates project dimensions and quantity of material considerations to determine pay items.

2. Definitions

a. Allowable down time. "Allowable down time" is "Noneffective working time" (see Noneffective working time).

b. Allowable overdepth not dredged. "Allowable overdepth not dredged" is the volume of "Allowable overdepth yardage" that is estimated and will not be dredged.

c. Allowable overdepth yardage. "Allowable overdepth yardage" is the volume of material between the required pay prism and the maximum pay prism.

d. CEDEP. CEDEP is the acronym for the three Corps of Engineers Dredge Estimating Programs that operate on microcomputers. The three programs developed are Pipeline CEDEP, Mechanical CEDEP, and Hopper CEDEP.

e. Dredging time. "Dredging time" is "Operating time" plus "Allowable down time."

f. Effective working time. "Effective working time" is time during the dredging operation when actual production is taking place, such as material moving through the pipeline. "Effective working time" is chargeable to the cost of work.

g. Gross production cost. "Gross production cost" is the cost of dredging the gross yardage. It is determined by multiplying the total monthly cost by the dredging time in months and adding the fixed and indirect costs.

h. Gross yardage. "Gross yardage" is the "Net pay yardage" plus the "Nonpay yardage."

i. Lost time. "Lost time" is downtime, which is not operational, normally due to a lack of required crew, major repairs and alterations, drydocking, cessation, and collisions. "Lost time" is not chargeable to the cost of work.

j. Maximum pay yardage. "Maximum pay yardage" is the sum of the "Required yardage" and the "Allowable overdepth yardage."

k. Net pay yardage. "Net pay yardage" is the "Maximum pay yardage" minus the "Allowable overdepth not dredged."

l. Nonallowable downtime. "Nonallowable downtime" is "Lost time" (See "Lost Time").

m. Noneffective working time. "Noneffective working time" is time during the dredging operation when the dredge is operational but no production is taking place, such as making changes to pipelines, cleaning trash from the suction head, minor operating repairs, and moving between locations. "Noneffective working time" is chargeable to the cost of work.

n. Nonpay yardage.

(1) "Nonpay yardage" based on excavation measurement is the volume of material estimated to be removed from outside the maximum pay prism.

(2) "Nonpay yardage" based on fill measurement is the volume of material that results in overfill and/or washes away.

o. Operating time. "Operating time" is the "Effective working time" (See "Effective working time").

p. Percentage of effective working time. See "Time efficiency."

q. Required yardage.

(1) "Required yardage" based on excavation measurement is the volume of material to be removed from within the required pay prism.

(2) "Required yardage" based on fill measurement is the volume of material to be placed within the pay prism.

r. Time efficiency. "Time efficiency" is the ratio of the "Operating time" to the "Dredging time," and is expressed as a percentage. Also known as "Percentage of effective working time" (% of EWT).

3. Development of Dredging Estimate

It is the general policy of the Corps of Engineers that dredging estimates be performed by Cost Engineers. The method of development of dredging estimates, in descending order, are as follows:

a. Historical information. The simplest and most reliable approach for estimating production for all types of dredges is to rely upon dredging records for the same or similar type work performed by the same or at least a similar dredge. The dredging records, Reports Control Symbol ENGCW-0-13 prescribed by ER 1125-2-304, includes the following daily dredging reports: ENG Form 27, Report of Operations-Hopper Dredges; ENG Form 3735, Report of Operations-Sidecasting Dredges; ENG Form 4267, Report of Operations-Pipeline, Dipper or Bucket Dredges. If project conditions have changed, for example a different horsepower or haul distance, historical production information must be adjusted and documented for use in the estimate. Using such adjustments is a valid method for obtaining production rates when historical data is not available. Some valuable sources of historical dredging data include daily reports of operations, operations personnel, other districts, and regional dredge teams. Cost and pricing data may be obtained from audits and contract modifications. Adjustments should be made to this data reflecting current pricing levels.

b. Similar projects. Information may be obtained from similar projects with similar characteristics to prepare a dredging estimate.

c. Regional dredge teams. The use of regional dredge teams is recommended. Members of regional dredge teams can be contacted for guidance on production rates, effective times, cost data, or other pertinent information (Appendix H).

d. A combination of the methods described, as previously described, may be used at the discretion and judgment of the Cost Engineer.

e. Computer programs. When historical data is not available, CEDEP may be used to compute a production rate, or the production rate may be computed using recognized commercially generated programs or industry generated programs. The Cost Engineer should include in the estimate a complete statement of the source(s) of computer program(s) used in the estimate.

4. Project Overview

The Cost Engineer should review the scope of work for the following items and determine which items are judgmental and which are factual at the time the estimate is prepared.

a. Location of work. This information is necessary to make a determination of availability of historical data, plant availability, mobilization distances, disposal areas, and restraints placed on the various types of dredge operations.

b. Type of material to be dredged. Information may be obtained from geotechnical investigations, historical data of specific site or adjoining areas, site visits, or similar projects with similar characteristics.

c. Placement area. Information should be obtained on location, size, type, regulatory and permit requirements.

d. Project dimensions. Project dimensions may include such items as length, width, depth, and channel alignment.

e. Site restrictions. This may include such items as waterway usage, vessel traffic, as well as time, weather, noise, and environmental restraints. Many areas are subject to restricted dredging seasons. To minimize environmental impacts creating scheduling conflicts, higher costs may occur and must be considered and documented in the cost estimate.

5. Selection of Equipment

An economical dredge shall be selected. Dredge type and size depend mainly on availability, job duration, type of material, exposure to the elements, disposal area restraints, environmental restraints, and production requirements. The narrative will include the rationale used by the Cost Engineer for equipment selection.

a. Pipeline. The term "pipeline" refers to cutterhead, suction, and dustpan dredges. Pipeline dredges are sized by the inside diameter of the dredge discharge flange and they are effective in dredging densely packed materials. Although they are best suited for low-traffic areas and sheltered waterways such as rivers, bays, harbors, and canals, some pipeline dredges are equipped to operate in calm to moderate seas offshore. Pipeline dredges lend themselves well to shore disposal operations.

b. Hopper. Hopper dredges are sized or classed by their hopper capacity. However, a particular size dredge is actually limited by its weight carrying capacity and the environmental restrictions of the project. Hopper dredges operate in cycles, and they normally cover the length of the total dredging area, deepening it gradually. They are the most efficient dredge for excavating loose, unconsolidated material and are used mainly in exposed harbors and shipping channels where traffic and operating conditions rule out the use of stationary dredges.

c. Mechanical. Mechanical dredges include bucket, bucket-ladder, clamshell, and dragline dredges. Transportation of the dredged material is made by additional plant, tug and barge, or scow. Mechanical dredges are classified by bucket size and are best adapted for dredging fine-grained material. They are the most efficient dredge for working near bridges, docks, wharfs, piers, or breakwater structures.

d. Specialty. Some dredging projects have unusual conditions or unique project requirements that can not readily utilize standard dredge plant. There are a variety of specialized dredge plant which must be considered under these circumstances.

6. Production

In calculating production rates for dredging, effective time is commonly used. Lost time due to major repairs and alteration, cessation, and collisions is not used in dredging time calculations. All dredging projects will be estimated using the approved CEDEP software. Whenever possible, the production rate used in CEDEP should be based on historical data. When historical data is not available, the sequence described in paragraph 3, this appendix, shall be used.

a. Pipeline. Production is determined by the pumping rate and the effective time.

(1) Pumping rate is affected by items such as water depth, density of material, distance discharged, available horsepower, bank height, wave climate, disposal area restraints, environmental restraints, and dredge configuration, such as spud carriage, ladder pump, degassers, and hoffa valve.

(2) The effective time is affected by items such as weather, handling pipeline, moving swing wires, minor operating repairs, vessel traffic, repositioning the dredge, and surveys.

b. Hopper. Hopper dredge production is best evaluated in terms of its cycle components and the effective time.

(1) The hopper dredge cycle consists of excavation time, transport time, and disposal time. Excavation time per load may be limited to pumping to overflow only, due to environmental concerns, or may be continued beyond overflow to obtain an economic or a maximum load. Transport time may be affected by items such as ship traffic, weather, distance, and tides. Disposal consists of either gravity dumping or pumping out the material. The time required to gravity dump the material in open water depends on the type of material and the dredge. If the material is pumped out, the time becomes a function of pump size, discharge diameter, and pipeline length, similar to a pipeline dredge. The number of cubic yards per load depends on the hopper size, the dredge's load carrying capability, type and characteristics of material, distance to the placement area, and environmental concerns.

(2) The effective time is affected by items such as vessel traffic, minor operating repairs, and refueling.

c. Mechanical. To determine mechanical dredge production, the Cost Engineer must calculate both a dredge excavation cycle time and a haul cycle time. Effective time is considered separately for each cycle. The longer of these two cycle times determines the production rate. When the haul cycle time is longer than the dredge excavation time, the dredge is sitting idle while waiting on scows. Normally, when this occurs, the number of scows required is increased to achieve the most efficient cost.

(1) The dredge excavation cycle consists of excavating the material and loading scows. This cycle is affected by items such as bucket size, type of material, operator efficiency, and size of dredge. Effective time is affected by items such as weather, vessel traffic, repositioning of dredge, and minor operating repairs.

(2) The haul cycle consists of transport time and disposal time. This cycle is affected by the size, type, and number of scows available, as well as the size, type, and number of towing vessels available. Effective time is affected by items such as weather, vessel traffic, and minor operating repairs.

d. Specialty. The Cost Engineer will have to investigate in detail the method, equipment, and expected production on a case-by-case basis.

7. Monthly Costs

The monthly costs for all types of dredges are based on labor, equipment, and other monthly costs.

a. Labor costs consist of wages, fringe benefits, taxes, and insurance. Labor consists of personnel necessary for the operation of the dredge, attendant plant and equipment with required supervision, and shore personnel used for the dredging work.

b. Equipment costs consist of ownership costs and operating costs. Costs for dredge plant will be based on historical data. In the absence of valid historical data, the CEDEP will be the basis for cost of dredge plant. Other equipment costs shall be obtained from EP 1110-1-8.

c. Other monthly costs are to be determined by the Cost Engineer. These may include such things as surveys, environmental monitoring, and navigation aids.

8. Fixed Costs

The fixed costs for all types of dredges are project specific. They are one-time costs for the project that are not included elsewhere.

9. Pay Items

a. Mobilization and demobilization. The cost estimate for this item consists of the following:

(1) Preparing dredge and attendant plant for transfer. Costs incurred may consist of such items as preparing laid up equipment for use, reinspection, and stocking equipment and supplies.

(2) Mobilization transfer costs. This item includes the cost to move all plant and equipment and the return of the tug or towing vessels(s).

(3) Preparing the plant for work. This item includes all preparation costs which are incurred to set up the equipment to start work, assemble, and place discharge line and boosters.

(4) Construction support site. Establishing a work yard at or near project site may be necessary and is a part of mobilization cost.

(5) Demobilize plant. This item includes preparing the dredge and attendant plant for transfer.

(6) Demobilization transfer costs. This item is similar to mobilization transfer costs. Mobilization and demobilization distances may not necessarily be the same. Reasons for using different distances must be documented.

(7) Prepare plant for lay-up. This item includes all costs to secure machinery and equipment for storage.

(8) Indirect costs. Indirect costs must be included in the mobilization and demobilization pay item. They

should be the same as those used for the dredging pay item.

b. Dredging. Pay for unit price contracts may be based on volume, area, time, scow or bin measure, or lump sum as described in ER 1130-2-307. To determine the unit cost of dredging, divide the gross production cost by the number of pay units.

(1) Pipeline dredge gross production costs consist of costs associated with dredging time and are not separated by elements of work.

(2) Hopper dredge and mechanical dredge gross production costs consist of costs associated with excavation time, transportation time, and disposal time.

(3) Specialty dredging gross production costs will be determined on a case-by-case basis.

c. Total dredging cost includes mobilization and demobilization cost plus dredging cost, previously discussed in paragraphs 9*a* and 9*b*, respectively.

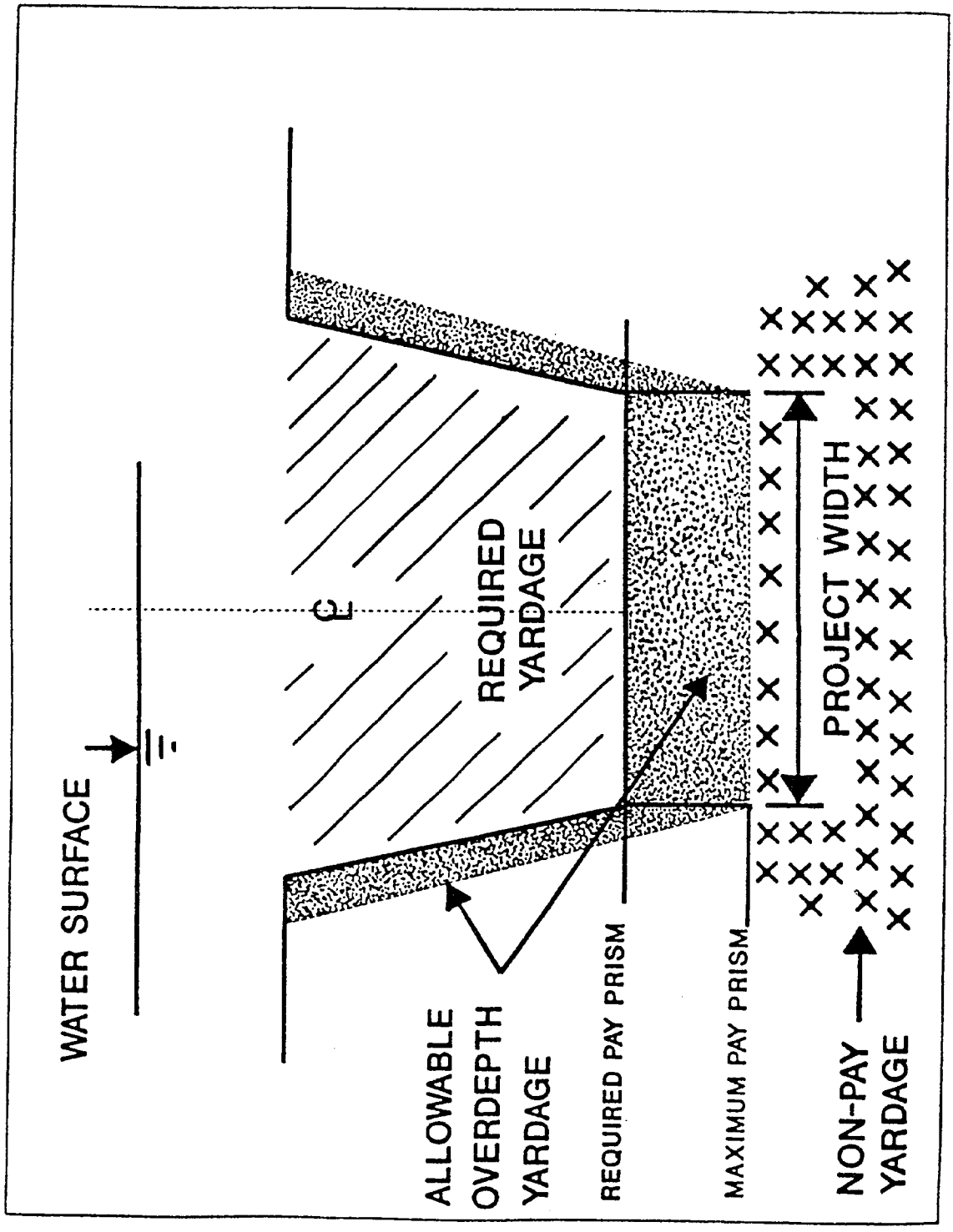
WATER SURFACE
ALLOWABLE OVERDEPTH YARDAGE
REQUIRED YARDAGE
REQUIRED PAY PRISM
MAXIMUM PAY PRISM
NON-PAY YARDAGE
PROJECT WIDTH
MAXIMUM PAY YARDAGE = REQUIRED YARDAGE + ALLOWABLE OVERDEPTH YARDAGE
NET PAY YARDAGE = MAXIMUM PAY YARDAGE - ALLOWABLE OVERDEPTH NOT DREDGED
GROSS YARDAGE = NET PAY YARDAGE + NON-PAY YARDAGE

Figure G-1.